KONZA PRAIRIE BIOLOGICAL STATION

Tallgrass Gazette

Spring 2005

"The Newsletter for Docents and by Docents"

Grasshoppers — their role in North American grasslands

By Dr. Anthony Joern, Division of Biology and LTER Researcher

Grasshoppers are often major herbivores in North American grasslands, with combined biomass often reaching or exceeding total biomass of large mammalian grazers. Just what role do grasshoppers play in North American grasslands? Grasshoppers are not miniature bison or cattle, and they do not have the obvious impact on the physical structure resulting when bison or cattle graze. Does this mean that grasshoppers are not important? Not at all. Grasshoppers are centrally located in food webs, influencing both plants that serve as food and the predators that consume them. They sometimes eat as much or more vegetation as mammalian grazers, redistribute nutrients affecting nutrient cycles, are a major source of food for predators and parasitoids, and they contribute greatly to biodiversity in grasslands.

Two Stripped Grasshopper

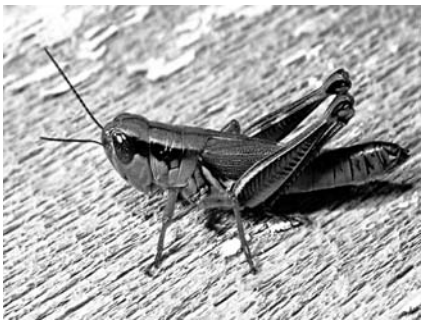
A great number of species of coexisting grasshoppers in North American grasslands – each with unique natural histories – leads to many individual stories. However, it is often useful to generalize when thinking about system-specific and ecosystem responses, the approach taken here. In Kansas, we distinguish between short-horned grasshoppers (family Acrididae) and long-horned grasshoppers or katydids (family Tettigoniidae), but lump these here as they are very similar in an ecological sense.

There are 700-800 species of grasshoppers in North America, 125^{+} species in Kansas, and just over 35 species at Konza Prairie. In Nebraska sandhills grassland, comprised of a more open habitat, 70^{+} grasshopper species have been collected at the Nature Conservancy-owned Arapaho Prairie. For perspective, these values correspond roughly to the diversity of bird species at national and state levels, but are much greater at a single grassland site. Of course, grasshoppers are poorly represented in woodlands, a primary habitat for birds. If gallery forests of Konza are included, the number of species is roughly the same for the two groups. It is worth recognizing that species are widespread throughout Great Plains grasslands, in part because of the lack of mountains or other barriers that promoted species complexes from speciation. The maximum species richness occurs in northern Oklahoma in a biogeographic context, dropping off somewhat as one moves north or south. New Mexico is a major center of grasshopper diversity in the US, reflecting the existence of both grassland and desert species mediated by significant elevational effects.

Differential Grasshopper

Grasshoppers eat plants to meet nutritional needs (but cannot digest cellulose), and much of their water is obtained from plant tissue as well. Actual grasshopper diets have been compiled by examining food material removed from the crop (the first organ in the digestive system), where plant species can be identified by examining small hairs on the leaf surface (trichomes) coupled to patterns of cell wall

structure. Unlike many insect herbivores which are highly specialized on single or a few plant species, grasshoppers tend to be more generalist in their diets. However, even generalist grasshoppers do not feed indiscriminately and tend to be either forb-feeders or grass-feeders exclusively, with only a few species eating both grasses and forbs. Mandible structure in these two groups differs, reflecting the different challenges in physically handling grass vs. forb leaves. One of the key factors driving grasshopper population change is the nutritional quality of food plants, where protein levels can greatly influence survivorship of nymphs and reproduction of adults. In addition, most forbs contain various chemicals that deter feeding that must be overcome by detoxification systems during digestion. Food plant quality is highly variable in space and time, with major differences occurring among years. Population change among years is, in part, determined by variability in food quality – a so-called bottom-up process.



Large Head Grasshopper

Grasshoppers are ectotherms, meaning that body temperature is determined by prevailing external conditions of the physical environment. Grasshoppers maintain body temperatures at about 36°-38°C, about the same level observed in humans. Body temperature is important because it affects all aspects of the biology of this species – feeding and digestion rates, escape capabilities, developmental rates, ability to fend off disease, and metabolic rate leading to total energy consumption. Thermal regulation is accomplished by orienting the body at appropriate angles to incident rays of the sun. Grasshoppers can often maintain body temperatures 10-15°C higher than ambient air temperatures measured in micro habitats near where the grasshoppers are located.

Lubber Grasshopper

Grasshoppers are attacked by wide range of "natural enemies", including vertebrate predators (birds, lizards, and coyotes), invertebrate predators (spiders, other insects such as robber flies or various beetles), invertebrate parasitoids (organisms that seem parasitic but actually kill the host from a number of insect families and worm phyla) or parasites (mites), and pathogens (bacteria, viruses and fungi). For many bird species, grasshoppers are a primary prey item when feeding nestlings as they develop. Each life cycle stage of grasshoppers is attacked by different groups of organisms, making it very difficult to isolate which factor(s) is(are) most important source(s) of mortality affecting the dynamics of grasshopper populations. However, a number of field-based experiments have documented that birds, lizards and wandering wolf spiders can significantly reduce grasshopper densities, at least some of the time.

Slant Face Grasshopper

The variation in abundance in grasshopper populations is sometimes legendary. However, no North American species shows the migratory and devastating effects seen in locusts (which are also grasshoppers) from almost all other parts of the world. While many hypotheses and mechanisms have been proposed to explain grasshopper population dynamics, the actual explanation will require linking a combination of factors in a way that is not yet understood. Good ideas abound, but much research remains to be performed before we can explain, let alone predict, grasshopper outbreaks. However, because weather-related events are involved indirectly in many of the possible explanations, our ability to predict grasshopper population dynamics will increase greatly when we can predict the weather. In other words, we have a ways to go.

Prairie Patter

by Dr. Valerie Wright, Environmental Educator and Naturalist

With the winter nearly behind us, it's time to rev up for training, school groups, and tours. We had a successful Docent Roundup, lassoing a herd of nearly 30 to hear about "little bison" – grasshopper grazing effects from Dr. Joern. In-service training with Jackie Nooker speaking on the sex life of prairie chickens brought almost as many docents.

An exciting 24 new recruits for docent training are from all backgrounds. They gave us the sense as a group that they were ready and willing to learn about the tallgrass prairie. Dr. Hartnett spoke to them of the Konza mission in research, education and conservation. Several of our experienced docents were present to answer their questions and show them the hospitality that has come to be a part of our volunteer message.

Loren Alexander speaking at New Docent Orientation

Soon the voices of children will be calling out measurements across the prairie to classmates with clipboards. More than a dozen teachers have already signed up for different spring SLTER science activities. We will for sure be in Kings Creek for the stream geomorphology study this spring. And the Fire Reversal Study will have data on those ever changing shrub islands before the burn in April.

The docent profiles Annie has been collecting in a notebook make interesting reading. We have learned new things about docents we have known for years. What an interesting and diverse group! Did you know that Howard Beikman worked with Caterpillar for 22 years and now he prefers Grasshoppers? Did you know that Myron Calhoun once was detained in Nigeria on suspicion of spying? Clyde Ferguson's words of wisdom are: "Take care of your feet. You might become a docent some day." If you haven't yet sent us your information, please do.

Announcements

Watch for an announcement about a volunteer workday. March 13 looks like the best date (a Sunday afternoon). We have trails to clean up, signs to replace on both the Nature Trail and Kings Creek, and repair work at the stream geomorphology site where a bank has slipped unto our transect markers. Also we'll need a few volunteers to monitor the Hokanson Homestead when K1A is burned (date to be announced).

If you didn't pick up a training and in-service schedule at a recent event, please see the one posted on the web site (www.ksu.edu/konza/keep). It has changes in it since the handout at the Docent Roundup.

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Good Girls Like Bad Boys: Prairie-Chickens in Love

Story and Photos by Jacqueline K. Nooker. Division of Biology, Kansas State University

In April, groups of male Greater Prairie-Chickens gather at booming grounds to attract a female. Their scientific name, *Tympanuchus cupido*, literally means "booming god of love"and refers to the romantic tendency of males to gather and broadcast their 'love' for females through a booming call.

Males arrive before dawn and defend territories no bigger than a small two-car garage. The female visits the booming ground to select a mate, but then tends the nest and raises the young on her own. Females seem to be very choosy when they are determining with whom to mate, even though the females are not obtaining food or nesting areas from the male. Only a few males get most of the copulations (8.6% of males receive 74.4% of the copulations), and successful males seem to be in the center of the booming grounds. I wanted to test this observation that central males are the most successful, but to also examine the effects of behavior and physical characteristics. I predicted that males would receive more copulations if they: 1) defended territories in the center of the booming grounds, 2) performed more vigorous display behavior, and 3) were in better condition physically.

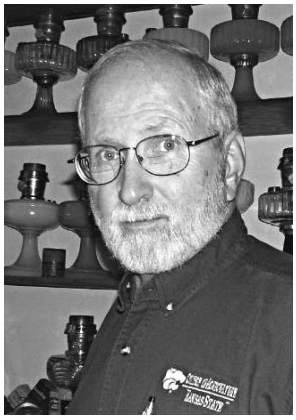
Near Manhattan, KS, three assistants and I observed four booming grounds of 10-12 males from 2003-2004. Each year, the males were captured, measured, weighed, and given a unique combination of colored leg bands to allow us to identify each bird individually. We observed the booming grounds daily, and recorded the positions of males relative to grid stakes and which males obtained copulations.

To quantify behavior, we observed a single male for 10 minutes. During this time, we recorded how much time the focal male spent displaying and fighting, and tallied the number of boom vocalizations, flutter jump displays, and the number of fights engaged. We used these measurements to develop two indices of behavior: display intensity and aggressive intensity.

My results generally supported my predictions. Males at the center of the booming ground were more likely to obtain copulations than those at the periphery, as per Prediction 1. Territory size was not related to mating success. Supporting Prediction 2, successful males performed more vigorous displays, but they were also much more aggressive toward other males. I also found support for Prediction 3: Heavier males obtained more copulations than lighter males. In addition, successful males also had larger combs, the brightly-colored fleshy portion of skin above the eye, similar to the comb of domestic chickens. There was no correlation between mating success and physical size (wing length, leg length) or age. Examining territory size, behavior, and morphology simultaneously, display behavior and territory position were no longer important. Only aggressive behavior, weight, and comb size were correlated with male mating success.

The importance of aggressive behavior was an unexpected outcome. Previous research has focused on territory attributes, largely ignoring behavior. Assuming all girls are 'good', and aggressive behavior in males is 'bad', I provide scientific evidence that Good Girls like Bad Boys in prairie-chickens. Since testosterone may be the physiological cause of varying male behavior, future work will quantify testosterone and determine if there is a correlation between testosterone level and aggressive male behavior.

SPOTLIGHT! on Bob Davis *By Annie Clark and Bob Davis*



Bob Davis

Bob Davis has been a docent since 2002 and became a Docent Committee member in 2005. As a retired Extension Supervisor and Educator, Bob enjoys working with people of all ages and being outdoors.

Growing up in Peabody, Kansas, Bob spent time outdoors helping his father and two brothers on the family farm. His mother was an elementary school teacher, and both parents encouraged and placed a high value on education. During elementary and high school, Bob was active in 4-H, FFA and sports.

Bob received a BS in Agricultural Education and an MS in Adult Education from Kansas State University. His college experiences gave him a well-rounded education in agriculture and allowed him to work with rural people and youth. After teaching vocational agriculture for 3 ½ years at Garnett, Kansas, Bob began a 34 year career with the Cooperative Extension Service before retiring in 2001. During his career, Bob worked as an Extension 4-H/Youth Agent in two Kansas counties for 24 years, and as a District Supervisor for the South Dakota State University Cooperative Extension Service, Brookings, South Dakota.

Bob and his spouse, Jan, are high school sweethearts who have been married for 46 years. They chose to retire in Manhattan because it is a university town, and because Manhattan is close to their three daughters and their families, including four grandchildren! In his free time, Bob enjoys photography, simple woodworking, reading historical novels, and antiquing. Additionally, he is on the United Way of Riley County Board of Directors and is active within the First United Methodist Church. Bob has a unique hobby collecting and restoring Aladdin kerosene lamps. Since 1994, he has collected 50-60 lamps, which can sell into the hundreds of dollars depending on their condition and rarity. As a member of the Aladdin Knights, Bob has traveled nationally to participate in meetings with other collectors and enjoys the challenge and satisfaction of finding and reconditioning lamps.

Bob became a Konza Prairie docent because of his passion for learning and for sharing his knowledge with others. He enjoys the challenges of learning about the tallgrass prairie, and feels fortunate to live in the beautiful Flint Hills where he has the opportunity to share the beauty with others. Bob enjoys being on Konza and working with youth and adults. Bob's favorite activities on Konza Prairie include the Nature Trail, Butterfly Hill, Bison Loop and grasshoppers.

Greater Prairie Chicken Viewing

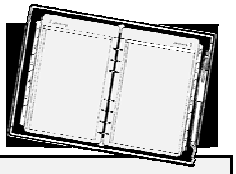
Photo by: Jackie Nooker

In-service training: Docent Prairie Chicken observations are back by popular demand. Saturday, April 16 and Sunday, April 17, 2005 meet your docent guide at the Scenic Overlook on highway 177 before daylight and car pool to the blind. Experience the booming of the prairie chickens as they celebrate the spring mating season. We are limited to 7 persons in the observation blind each morning, so get your reservations in early! To reserve your space, contact Annie Clark at (785) 587-0381 or bunny@ksu.edu.

Share this unique opportunity with friends and neighbors! KPBS is taking public reservations for its prairie chicken blind from March 15 to April 15, 2005. Viewing the courting behavior of the Greater Prairie Chickens will be allowed with a guide assigned by KPBS with a charge of $10.00 per person. Details of where to meet and times, as well as regulations will be given when the reservation is scheduled. In general, we enter the blind before daylight and remain in the blind until approximately 8:30 a.m. or until the birds have flushed.

Docent Yearbook - be the first on your block!

By Annie Clark



Beginning in 2005, I would like to obtain a "Konza Docent Profile" from all graduates of the Docent Program. The profile includes information such as favorite Konza activities, favorite Konza subjects to study, memorable Konza experiences, life background/career, hobbies other than Konza, and anything else you would like to share about yourself. A picture should accompany your profile. Please include a close-up (digital or hard copy) of yourself or ask Valerie or me to take one for you during an up-coming in-service, training or other activity.

Konza Docent Profiles will be complied to form the ***Konza Docent Yearbook***, which will be available in the Education Center. The purpose of the yearbook will be to capture the essence of the docent program and document its successes. I believe it is important to create a docent archive that will allow docents to find other docents who have similar interests, match a name to a face, and allow each other to share a little bit about themselves. Each season a picture and bio of each new docent graduate, pictures from training, in-service and special events, and pictures of docent-led school and public groups will be added to the yearbook.

Pick up a Konza Docent Profile form at the Education Center or ask Annie Clark to email it to you. Return profiles via e-mail bunny@ksu.edu, mail Konza Prairie, KSU Div. of Biology, 232 Ackert Hall, Manhattan, KS 66506, or personally. Remember, I would like your picture, too! Please call with any questions or concerns, (785) 587-0381.

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